18

THE *Deſcription* of a NEW *Univerſal* MICROSCOPE,

Which has all the Uſes of the

SINGLE, COMPOUND, OPAKE,

AND

AQUATIC MICROSCOPES.

With particular *Directions* for the *Uſe* and APPLICATION of every *Part* of the Apparatus, as repreſented and illuſtrated in a large *Copper-Plate*.

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By B. MARTIN.

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ADVERTISEMENT.

SOME Years ago I publiſhed the Deſcription and Uſe of an Univerſal Microſcope of a different Conſtruction from any that had been made before; with an Apparatus of a more General and Extenſive Uſe. This Microſcope was very well received by the Public, and a great Number of them were, of courſe, ſold both at Home and Abroad, which was entirely owing to ſuch an advantageous Compoſition and Diſpoſition of the Glaſſes, that the Field of View, the principal Excellency of this Inſtrument, was greatly enlarged thereby, and became more diſtinct, and Objects leſs diſtorted and coloured in the extreme Parts, than they are in the common Conſtructions. But Improvements in Inſtruments, as in the Sciences which ſuggeſts them, are of a progreſſive Nature, and advance towards Perfection by ſlow Gradations. By encreaſing our Knowledge of the Theory, and an unintermitting Attention to Experiments, we arrive ſucceſſively to a greater Skill in the genuine Fabrication of Machines, a ſuperior Dexterity in contriving the Apparatus, and Adroitneſs in the Uſes of all the Parts. This is the Caſe, in a peculiar Manner, with reſpect to Optical Inſtruments, and in particular the compound Microſcope as muſt be evident to any one who ſhall compare the preſent Fabric of that capital Inſtrument with what the Great HUGENIUS *firſt of all publiſhed upwards of* 100 *Years ſince. And the Caſe is ſtill more widely different between the original Solar Microſcope by* DR. LIBERKHUN *and thoſe we make at this Time.*

The Microſcopes and Apparatus above deſcribed are the beſt and moſt commodious for general Uſe of any we can at preſent think of, and much exceed any we have made or publiſhed before; but for the Curoius Enquirer *into the moſt minute and recondite Parts of Nature's wonderful Works, there ſeems wanting another Set or Conſtruction of Microſcopes, both Single, Compound and Solar, peculiarly adapted for exploring the* Arcana Naturæ *to a moſt exquiſite Degree. This ſet of Microſcopes is a* Succedaneum *to the Common* large Parlour Microſcope, *beginning where that Ends,* viz. *with Objects about the* $\frac{1}{500}$ *of an Inch; for when they are thus ſmall, they ceaſe to be the proper Subjects of a large compound Microſcope, as they cannot be ſo diſtinctly and ſatisfactorily ſeen as could be wiſhed, by an Object Lens of* $\frac{1}{10}$ *of an Inch focal Diſtance, and even then the Magnifying Power is not more than about* 450 *times in Diameter. But in the ſmall compound Microſcope we can with much greater Perſpicuity ſee the ſame ſmall Objects though magnified in a much greater Degree,* viz. *a* 1000, 1500, or 2000 *times; and it is poſſible, by a particular Apparatus, to ſee Objects compleatly, not more than* $\frac{1}{10000}$ *of an Inch, though magnified* 3 *or* 4 *Thouſand times in Diameter; and I have Drawings of Objects by me now, as they appeared in this ſmall Compound, magnified* 5760 *times in Diameter, which is more than* three times *the magnifying Power of the deepeſt* Palina *(or Spherule) which the reverend Father* De Torrè *has ſo much extolled in his late* Treatiſe of Microſcopic Obſervations, *and which he ſays magnifies* 1900 *times; for tho' he mentions others which magnify* 2500 *times, yet there is no Inſtance of his uſing them in any one of all his numerous Experiments.*

This new ſet of ſmall Microſcopes, together with a very large Collection of rare and curious Objects, is now nearly finiſhed, and will, if Life and Health permit, be ſoon publiſhed under the Title of the VIRTUOSO'S OPTICAL APPARATUS, *with a particular Account and Deſcription of every Part thereof, and its Uſes.*

THE DESCRIPTION OF A New CONSTRUCTION and APPLICATION Of a *Portable Apparatus* of MICROSCOPIC INSTRUMENTS;

With *Directions* for the *Uſe* of every Part.

FIG. I.

A B C D E, which is the Body of the Microſcope; this conſiſts of four other parts, viz.

A B the Eye-piece, or that which contains the ſyſtem of Eye-Glaſſes; and is ſcrew'd into

B C the Moveable or Sliding Tube, on the top; this inner Tube contains the Body-Glaſs ſcrewed into its lower part.

C D is the exterior Tube, or Caſe, in which the other ſlides up and down, in a moſt eaſy and equable manner.

D E is a Pipe, or Snout, ſcrewed on to the Body of the Microſcope at D; and, in it's lower Part, over the ſeveral Magnifying Lenſes, of which bye and bye.

F G H I K is the Stem or Stand of the Microſcope, and conſiſts of three Parts, or Tubes, viz.

F G which is the inmoſt of the three, and ſlides up and down by the hand, in

G H the Middle Tube, which is moved in the ſame manner by rack-work of Tooth and Pinion, in

I K the outer Caſe, or Tube of the Stem.

K L is a ſtrong ſolid Joint by which the Poſition of the inſtrument is readily altered from a vertical or upright one, to an oblique one, in any degree required.

M is a circular Piece of Braſs, ſerving as a Baſe to the Pillar, and

N O P the Tripod, or Foot, by which the whole body of the Microſcope is ſteadily and firmly ſupported.

Such is the Form and Fabric of this new compound Microſcope. The Apparatus, its various Parts, and the Uſes of each, now follow:

Q Is a circular Braſs Box, containing Six Magnifiers, or Object Lenſes, numbered 1, 2, 3, 4, 5, 6, which Digits appear ſeverally through a round Hole on the upper Plate. To the under Side is fixed a ſmall Circle of Braſs, by which it is connected and faſtened to the round End of

a b c d, a long ſliding Piece of Braſs moving through

e f, a Socket in the upper Part of the inmoſt Tube, on a Cork placed upon a Springy Spiral, to give it a tight, yet eaſy and uniform Motion.

R is

R is a fixed Stage, on which Objects are placed to be viewed; it is firmly faſtened upon the upper Part of the exterior Tube of the Stand. In its Middle is a large circular hole for receiving Concaves with Fluids, &c.

a, *b*, *c*, are three ſmall Sockets, in Parts, projecting from the Rim of the Stage, for receiving ſeveral parts of the Apparatus.

S is the Refractor, or illuminating Lens, for converging the Sun's Rays upon opake Objects laid upon the Stage; to this end, it moves up and down in a Semicircle, upon a long Shank *a*, in a ſpringy Socket *b*, upon an Arm *c*; and this Arm itſelf moves every way by a ſtout Pin in the Spring-Socket *a* of the Stage. By theſe means it is readily adjuſted to any Height and Poſition of the Sun or Candle.

T is a long ſquare Bar of Braſs, upon which is moved up and down a ſtrong braſs Arm *a*, by means of a ſquare ſpringy Socket *b*, carrying at the other end

V the Reflecting Concave Speculum, deſigned for illuminating all tranſparent Objects upon the Stage. What elſe remains in the firſt Figure will be hereafter noticed.

FIG. II. Not in mine

IS a moveable Stage, which, by means of a Pin *(a)* placed in the Hole *(a)* in the fixed Stage R, is capable of a Motion in an horizontal Direction over the whole Field of View. In this Stage are three circular

circular Holes with ſhouldered Bottoms, viz. One large one *(b)* on each Side of which is a ſmall one *c*, *d*. Theſe are for the Reception of divers neceſſary Particulars, viz.

FIG. III.

A Watch-Glaſs to be put into the large Hole, with Fluids containing Animalcules, &c. Alſo

FIG IV.

A circular Piece of Ivory with one ſide white, the other black, for opake Objects of different Colours and Hues reſpectively. Alſo

FIG. V.

A Circular plain Glaſs for tranſparent Objects in any degree, for *extempore* Views. What has been ſaid of the large Hole is applicable to the two leſſer ones, *c* and *d*, when ſmaller Plates, Concaves, &c. will ſuffice.

F I *G.* VI.

Is the *Liberkhun*, or ſilvered Speculum, which makes the ſingle Opake Microſcope, being ſcrewed on to the Slider *a b c d*, (*fig.* 1. in the room of the Box of Lenſes Q.) The uſe whereof is to view very ſmall opake Objects, greatly illuminated near the Compound Focus of both the Speculums.

FIG.

F I G VII.

Is the *Forceps*, or Plyers, for holding ſuch kind of opake Objects, and by which they may be applied very readily to the Focus of the Lens, in the Center of the *Liberkhun*; for they have a Motion every way by means of the Spring Socket *(a)*, the Joint *(b)*, and the Shank (*c*), placed in the Socket *(c)* of the fixed Stage R.

F I G. VIII.

Is a ſmall Piece of Ivory to be put on the end *(c)* of the Plyers, being black on one ſide, and white on the other; on this the opake Object is wholly expoſed to the ſight, and is therefore ſeen moſt compleatly.

F I G. IX.

Is another, but larger *Liberkhun*, with a Hole in its Center; this is ſcrewed into

F I G. X.

The Hole *(a)* of a large braſs Ring, faſtened to a long Wire or Shank, *(b)* which moves up and down in the ſpring Socket *(b)* of the Stage R. in which it alſo moves laterally or ſideways; and thus it makes a compleat *Aquatic compound Microſcope* for

[illegible]
q: of any other uſe than to throw a ſtrong light on the object.

ſhewing all ſorts of Objects in Water and other Fluids, placed under it in the Watch-Glaſs (*Fig.* 3) on the Stage.

F I G. XI.

Is a Lens of a proper Focal Length, fixed in a braſs Box, which is to be occaſionally ſcrewed into the ſame Hole (*a*, *Fig.* 10) and then the Shank (*b*) placed in its Socket (*b*) on the Stage R. It now becomes a refracting Illuminator, and acts in conjunction with the large concave and plain Mirror V below, whoſe reflected Rays it moſt agreeably modifies, and renders them ſtedfaſt in the Field of View.

me query as the last,
if placed under the other
aperture does it not
fuse the object.

F I G. XII.

Is a ſort of Cone with an Aperture (*a*) at the ſmaller End, of a proper ſize to exclude all ſuperfluous Light when it is like to diſturb a critical Obſervation of curious Objects. It is placed on the under Side of the fixed Stage R.

F I G. XIII.

Is what is uſually called a *Bug-box*, conſiſting of a Concave Glaſs at (*a*), and a plain one (*b*) ſcrewed over it, by which means a Bug, Louſe, Flea, or any ſuch Object may be contained, and viewed alive. This is placed on either Stage, as reaſon may direct.

FIG.

FIG. XIV.

Is called the *Fiſh-Pan*, as in the long concave Body *(a b)* a Fiſh may be placed, and confined therein by the Ribbon *(c)* ſo that the tranſparent Tail may lie, in part, over the long Hole or Slit at *(a)*. In this condition it is placed on the Stage, with the Pin *(d)* in the Hole *(c)*, by which it is locked on, but is free to move horizontally for viewing the circulation of the Blood, &c.

FIG. XV.

Is the *Slider-Holder*, which is placed on the Stage R, to receive Sliders filled with Objects of the tranſparent Sort, to be viewed either with the *Compound* or *Single Microſcope*.

FIG. XVI.

Is an *Ivory Slider*, of the common ſort, with Holes containing Objects between two Talks, confined by circular Wires.

FIG. XVII. Not in mine

A framed *Slider*, in Braſs, on one Side of which are ſmall Holes, with Concaves fixed in them; and a long Slip of clear Glaſs ſlides over them; ſo that any very ſmall Animal, as Mites, &c. may be viewed without danger of their getting away, or of being cruſh'd to death.

F I G. XVIII.

Is a *Set* of *Three Glaſs Tubes*, one within another: they are to contain Tadpoles, Water Neuts, ſmall Frogs, Eels, &c. which are the beſt Subjects for affording a fine View of the Circulation of the Blood, placed in the Slider-Holder, (*Fig.* 15) under the Microſcope. There is a ſmall Hole at one End to admit Air when the other is ſtopped with a Cork to prevent the Animal's Eſcape, or too much Freedom of Motion.

F I G. XIX.

Is a ſmall Ivory Box of *Talks*, to ſupply the Sliders when any are loſt, or worn out.

F I G. XX.

A *Cell*, or *Button*, containing a very ſmall Lens, properly ſet between two thin *Laminæ* or Plates of Braſs, that it may approach very near the Object when viewed therewith as a Single Microſcope. Of theſe deep Lenſes there are two, for the purpoſes of viewing the minuteſt Objects, and magnifying them as much as conveniently can be. Theſe Buttons are ſcrewed into the ſame Hole as the Box Q which contains the ſix larger Lenſes.

F I G. XXI.

Is a *Lens*, duely accommodated to view and examine Objects by magnifying them juſt enough to be aſſured of the fitteſt Method of applying them on the Inſtrument for Inſpection; on this account it is uſually called the *Explorator.* May be ſcrewed to the hole of box Q.

F I G. XXII.

A *Pair* of *Nippers* for taking up any Object to be examined, applied to the Stage, taken from it, &c.

F I G. XXIII.

Is a *Camel's Hair Bruſh* at one end *(a)*, for cleaning the Glaſſes, Lenſes, &c. and the other end *(b)* is cut Pen-faſhion, for taking up Fluids, Eels in Paſte, &c. and readily placing them for view in the Glaſſes of the Stage.

In the Uſe of this Inſtrument it is to be obſerved, that the interior Tube or Drawer F G is moved up and down to procure the requiſite focal Diſtance for each reſpective Lens in the Box Q.

That to make this focal Diſtance perfectly exact, (when you have it nearly ſo by moving the Tube F G by the hand) you turn the Nut or Pinion W one way

or

or the other very gently, in the Teeth of the Rack-work at X, till you ſee the Object very diſtinctly, and there let it reſt.

It is, in every caſe, neceſſary for diſtinct Viſion, that the Center of the Object Lens, the Stage, and the Illuminators, ſhould all be in a right line, or Axis of the Microſcope; which is effected by turning the Tube F G ſo that the black Line *(g)* upon it may coincide with the mark *(h)* upon the Rim of the Tube H; and by ſetting the Arm *(a b c d)* with its mark on the Side, to the Edge of the Socket in which it ſlides.

By a Motion of the Tube F G horizontally, the view may be extended laterally over the whole Diameter of the Object or Field of View; as by moving the Arm *(a b c d)* forward or backward, you extend it equally in a contrary direction; and thus you view the whole of every Object, Quantity of Fluid, &c.

As the Braſs Arm *(a b c d)* may be raiſed to the height of three or four inches above the Stage R, ſo a Lens of a greater focal Diſtance than the greateſt in the Box Q may be occaſionally ſcrewed in place of the ſaid Box Q, and thereby the largeſt Microſcopic Objects may be viewed, and the Inſtrument, in this caſe, becomes a MEGALASCOPE.

Nothing has been ſaid of the Magnifying Powers by the different Object Lenſes of this Microſcope, it being a matter of great uncertainty, unleſs the focal

Diſtances

Diſtances of each could be very well determined, which cannot be done with any Preciſion but by a *Micrometer*, and this will give them with eaſe to the $\frac{1}{1000}$ Part of an Inch; as alſo the Dimenſions of Objects to the ſame Degree of Accuracy; but for the practical Method of doing this, the Reader muſt be referr'd to a Pamphlet lately publiſhed, entituled, *Microſcopium Pantometricum*, where he will meet with full Satisfaction in this Point.

FINIS.